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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003900048 for a patent by STRATECH SYSTEMS LIMITED as filed on 07 January 2003.

WITNESS my hand this  
Second day of February 2004

*J. Billingsley*

JULIE BILLINGSLEY  
TEAM LEADER EXAMINATION  
SUPPORT AND SALES

AUSTRALIA

Patents Act 1990

**ORIGINAL**

**PROVISIONAL SPECIFICATION**

**"AUTOMATED VEHICLE INSPECTION SYSTEM"**

**The invention is described in the following statement:**

## **AUTOMATED VEHICLE INSPECTION SYSTEM**

### **FIELD OF THE INVENTION**

The present invention relates to access to secure sites, and in particular to vehicular access to such sites.

5

### **BACKGROUND OF THE INVENTION**

It is necessary to control access of personnel and vehicles to sensitive sites, both civilian and military.

10 In recent decades, motor vehicles have been used in the type of terrorist activities that have come to be known as car bombings. Motor vehicles have been packed with substantial amounts of explosives and parked in a particular location where the explosives have been detonated, either with a timer or a remote control such as a radio link.

15

It is also the case that a motor vehicle that can legitimately be brought onto a sensitive site can be stolen or hijacked by a terrorist group, loaded with explosives and brought onto a sensitive site by a terrorist.

### **20 SUMMARY OF THE INVENTION**

In one aspect the present invention accordingly provides apparatus for the automatic inspection of motor vehicles as they are being driven into a secured site by a driver, the apparatus including:

database means containing:

25 biometric data identifying drivers who are permitted to drive vehicles into the secure site;  
licence plate data identifying vehicles which are permitted into the secure site; and  
data identifying which driver is permitted to bring which vehicle into  
30 the secure site,

means for capturing biometric data about a driver who is driving the motor vehicle into the secure site;

licence plate recognition means for capturing licence plate data about the motor vehicle which that driver is driving into the secure site; and means for interrogating the database means on the basis of the captured data about the driver who is driving the motor vehicle into the secure site and on the basis of the captured data about that vehicle to determine whether or not that driver is permitted to drive that vehicle into the secure site.

It is preferred that the biometric data identifying drivers who are permitted to drive vehicles into the secure site includes at least one of:  
an image of the face of each such driver; and  
a print of at least a portion of a hand of each such driver.

It is preferred that the apparatus further includes:  
database means for storing images of the undercarriages of vehicles which are permitted into the secure site;  
imaging means for capturing an image of the undercarriage of a vehicle as it is being driven into the secure site; and  
means for comparing the captured image of the undercarriage of the vehicle as it is being driven into the site with the stored image of the undercarriage of that vehicle.

It is preferred that the apparatus further includes means for detecting the presence of explosives associated with a motor vehicle that is being driven into the secure site.

It is preferred that the apparatus further includes:  
means for detecting physiological data about the driver who is driving the motor vehicle into the secure site;  
means for inferring, from the detected physiological data, information about the current psychological profile of the driver, and  
means for raising an alarm when the inferred current psychological profile of the driver matches specified criteria.

It is preferred that the physiological data includes data about the pulse rate of the driver. When this is the case, it is preferred that the apparatus further includes means for storing base-line pulse rate data about the driver and that the means  
5 for inferring the current psychological profile of the driver from the detected physiological data includes means for comparing the detected pulse rate of the driver with the base-line pulse rate data for that driver.

It is preferred that the specified criteria include the stress level of the driver.  
10 It is preferred that the means for detecting physiological data is part of the means for capturing biometric data.

It is preferred that the licence plate recognition means includes a licence plate  
15 recognition camera.

It is preferred that the apparatus is arranged in three zones, being:  
an identification and psychological profiling zone, in which zone is located  
the means for capturing biometric data about a driver who is driving the  
20 motor vehicle into the secure site;  
an automatic inspection zone, in which zone is located the imaging means  
for capturing an image of the undercarriage of a vehicle as it is being  
driven into the secure site; and  
a manual inspection zone.

25 It is preferred that:  
a vehicle is visible to the licence plate recognition camera on entry of the  
vehicle into the identification and psychological profiling zone; and  
on detection by the licence plate recognition camera of a vehicle entering  
30 into the identification and psychological profiling zone, the licence plate  
recognition means is triggered to capture licence plate data about the  
motor vehicle.

It is preferred that the apparatus includes means, under the control of the apparatus, for selectively preventing and allowing the movement of the vehicle from the identification and psychological profiling zone into the automatic inspection zone.

5

It is preferred that the apparatus includes means, under the control of the apparatus, for selectively preventing and allowing the movement of the vehicle from the automatic inspection zone into the manual inspection zone.

- 10 It is preferred that the apparatus includes means, under the control of the apparatus, for selectively preventing and allowing the movement of the vehicle from the manual inspection zone into the secure site.

- It is preferred that components of the apparatus that are located in at least one of  
15 the identification and psychological profiling zone, the automatic inspection zone and the manual inspection zone be hardened against the effects of explosive blasts.

- It is preferred that the means for detecting the presence of explosives associated  
20 with a motor vehicle are located in the automatic inspection zone.

It is preferred that the means for detecting the presence of explosives includes a detecting portal through which the car is driven.

- 25 Thus, in its broadest aspect, the present invention allows for the verification of both the identity of the driver and the identity of the vehicle, to establish that the particular vehicle is permitted into the sensitive site and that it is currently being driven by a driver who is permitted to drive it into that site.

- 30 In its subsidiary aspects, the present invention also allows for the scanning of the vehicle for explosives or other illicit material.

In another aspect, the present invention provides a method of controlling vehicular access to a secure site, which method includes the steps of:

at at least one entrance to the site, designating a plurality of inspection zones, wherein each inspection zone is contiguous with at least one other inspection zone and at least one inspection zone is contiguous with the secure site;

permitting a driver to bring a vehicle which is seeking access to the secure site to enter into an inspection zone;

conducting at least one inspection process on the vehicle in each of at least two inspection zones, wherein each inspection process has allowable outcomes which include:

the vehicle fails the inspection process and is not permitted to move out of the inspection zone; and

the vehicle passes the inspection process and is permitted to move out of the inspection zone.

In yet another aspect, the present invention provides a method for the automatic inspection of motor vehicles as they are being driven into a secured site by a driver, the method including:

storing in a database:

biometric data identifying drivers who are permitted to drive vehicles into the secure site;

licence plate data identifying vehicles which are permitted into the secure site; and

data identifying which driver is permitted to bring which vehicle into the secure site,

capturing biometric data about a driver who is driving the motor vehicle into the secure site;

capturing licence plate data about the motor vehicle which that driver is driving into the secure site; and

interrogating the database on the basis of the captured data about the driver who is driving the motor vehicle into the secure site and on the basis of the captured



data about that vehicle to determine whether or not that driver is permitted to drive that vehicle into the secure site.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

5 In the drawings:

Figure 1 shows an overview of apparatus according to one embodiment of the present system;

Figure 2 is a flowchart illustrating the operation of the apparatus of Figure 1;

10 Figure 3 shows the logical architecture of the embodiment of Figure 1;

Figures 4 and 5 are block diagrams of sub-systems of Figure 3; and

Figure 6 is an example of the user interface of the embodiment of Figure 1.

### **DESCRIPTION OF PREFERRED EMBODIMENT**

15 **The apparatus of the invention**

A preferred embodiment of the present invention is illustrated generally at item 1 in Figure 1.

20 The arrangement of apparatus according to the embodiment of Figure 1 is in three zones, an identification and psychological profiling zone 2, an automatic inspection zone 3 and a manual inspection zone 4.

The apparatus of the present invention includes a control centre 13. Control and/or signal paths connect components of the system to the control centre 13.

25 Those components include biometric and heart rate detection station 8 with an attached console 7, a traffic light 9, an explosives detection portal 11, undercarriage scanning and speed sensor apparatus 12, a fixed camera 17, a hand-held camera 14, an alarm 18 and a spike barrier 19. It is preferred that the signal path between the hand-held camera 14 and the control centre 13 is at least

30 in part by way of a wireless personal area network (WPAN). According to alternative preferred embodiments of the invention which are not shown in the drawings, spike or other suitable barriers are also located at either or both of the transition regions between:

the identification and psychological zone and the automatic inspection zone; and  
the automatic inspection zone and the manual inspection zone.

- 5 The logical architecture 21 of the system of figure 1 is illustrated in Figure 3. The central server 22 is running licence plate recognition (LPR) software 26, under-vehicle image processing software 27 and database software 28. The central server 22 presents a user interface 23 to a user. A licence plate recognition system 31, driver image system 32 and under-vehicle scanning system 33 also  
10 have inputs to the central server 22.

Figure 4 is a representation of the architecture of the licence plate recognition system, the software 26 of which runs on the central server 22. This system includes a central computer 37 (which preferably is the same computer as the  
15 central server 22 of figure 3). The central computer 37 interfaces by way of suitable hardware such as frame grabber 38, serial communications port 39 and digital I/O card 41 with cameras and scanners 42 and 43. It will be appreciated that, although these cameras and scanners are numbered as items 42 and 43 in figure 4, their physical implementations include the LPR camera 17 of figure 1.  
20

Figure 5 is a representation of the architecture of the under vehicle scanning (UVS) and driver image capture systems. The central computer 37 interfaces by way of a frame grabber 51, video switch 52 and multiplexer 53 with driver image capture cameras 54 and under-vehicle scan cameras 56. It will be appreciated  
25 that, although the driver image capture cameras and under-vehicle scan cameras are numbered as items 54 and 56 in figure 5, their physical implementations include cameras 14 and 17 of figure 1 and the undercarriage scanning equipment illustrated as item 12 in figure 1.

### 30 OPERATION OF THE APPARATUS OF THE INVENTION

The following description of the operation of the apparatus of the invention should be read in conjunction with the top-level flow-chart of figure 2, which gives an overall view of that operation.

As a vehicle such as that illustrated at 6 in figure 1 is driven into the inspection system 1, the driver of the vehicle is presented with a red light by traffic light 9 (action 201 of figure 2).

5

When the vehicle 6 enters the identification and psychological profiling zone 2, it is detected by the camera 17. This detection of the vehicle triggers the licence plate recognition system. The licence plate recognition functions are then assigned to the camera 17. According to an alternative preferred embodiment of  
10 the invention which is not illustrated, the vehicle is detected by an inductive ground loop (which is not illustrated in the drawings) and licence plate recognition functions are then assigned to the camera 17.

The detection of the vehicle 6 triggers the licence plate recognition system and at  
15 the same time the driver is prompted to wind down the window, look into the facial identification camera adjacent the vehicle, and place his or her hand on a sensor in the biometric recognition and heart rate detection console 7. The placement of the driver's hand on this sensor also acts as a trigger to activate the facial identification system. According to preferred embodiments of the invention, the  
20 heart rate data that is captured is compared with base-line pulse rate data about the driver to infer whether or not the driver is exhibiting any nervousness.

The following decisions are then made.

Based on the output of the licence plate recognition system, a decision is  
25 made as to whether or not the vehicle is authorised to enter the secured zone (decision 203 of figure 2). If the vehicle is not authorised to enter the secured zone, and an alarm is raised (204 of figure 2).

Based on the output of the biometric recognition system, a decision is  
made whether or not the driver is a person who is authorised to enter the  
30 secured zone (decision 207 of figure 2). If the driver is not authorised to enter the secure zone, an alarm is raised (208 of figure 2).

Based on the output of a heartbeat detector, a decision is made whether or not the driver is exhibiting nervousness at entering the secured zone

(decision 212 of figure 2). If the driver is exhibiting such nervousness, an alarm is raised (213 of figure 2).

5 If none of these alarms is raised, the driver is presented with a green light (process 209 of figure 2) and drives the vehicle 6 through the explosives detection portal 11 and over the undercarriage scanning equipment and speed sensor equipment 12.

10 If any illicit material is detected on passage of the vehicle 6 through the explosives detection portal 11, an alarm is raised (213 of figure 2).

The image that is captured of the vehicle undercarriage is compared with previous undercarriage images from a database (215 of figure 2) and if there is a discrepancy between the images an alarm is raised (217 of figure 2).

15

If neither of these alarms is raised, an image of the vehicle interior is saved (218 in figure 2) the barrier 19 is opened and the vehicle is free to proceed into the secured facility.

**THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:**

1. Apparatus for the automatic inspection of motor vehicles as they are being driven into a secured site by a driver, the apparatus including:

database means containing:

5 biometric data identifying drivers who are permitted to drive vehicles into the secure site;

licence plate data identifying vehicles which are permitted into the secure site; and

10 data identifying which driver is permitted to bring which vehicle into the secure site,

means for capturing biometric data about a driver who is driving the motor vehicle into the secure site;

licence plate recognition means for capturing licence plate data about the motor vehicle which that driver is driving into the secure site; and

15 means for interrogating the database means on the basis of the captured data about the driver who is driving the motor vehicle into the secure site and on the basis of the captured data about that vehicle to determine whether or not that driver is permitted to drive that vehicle into the secure site.

20 2. Apparatus as claimed in claim 1 in which the biometric data identifying drivers who are permitted to drive vehicles into the secure site includes at least one of:

an image of the face of each such driver; and

a print of at least a portion of a hand of each such driver.

25 3. Apparatus as claimed in any one of the preceding claims, further including:  
database means for storing images of the undercarriages of vehicles which are permitted into the secure site;  
imaging means for capturing an image of the undercarriage of a vehicle as it is being driven into the secure site; and

means for comparing the captured image of the undercarriage of the vehicle as it is being driven into the site with the stored image of the undercarriage of that vehicle.

4. Apparatus as claimed in any one of the preceding claims, further including  
5 means for detecting the presence of explosives associated with a motor vehicle that is being driven into the secure site.
5. Apparatus as claimed in any one of the preceding claims, further including:  
means for detecting physiological data about the driver who is driving the  
motor vehicle into the secure site;  
10 means for inferring, from the detected physiological data, information about the current psychological profile of the driver, and  
means for raising an alarm when the inferred current psychological profile of the driver matches specified criteria.
6. Apparatus as claimed in claim 5, in which the specified criteria include the  
15 stress level of the driver.
7. Apparatus as claimed in claim 6, in which the physiological data includes data about the pulse rate of the driver.
- 20 8. Apparatus as claimed in claim 7, in which:  
the apparatus further includes means for storing base-line pulse rate data about the driver; and  
the means for inferring the current psychological profile of the driver from the detected physiological data includes means for comparing the detected  
25 pulse rate of the driver with the base-line pulse rate data for that driver.
9. Apparatus as claimed in any one of claims 5 to 8, in which the means for detecting physiological data is part of the means for capturing biometric data.

10. Apparatus as claimed in any one of the preceding claims, in which the licence plate recognition means includes a licence plate recognition camera.

11. Apparatus as claimed in any one of claims 3 to 10, in which the apparatus is arranged in three zones, being:

- 5        an identification and psychological profiling zone, in which zone is located the means for capturing biometric data about a driver who is driving the motor vehicle into the secure site;
- 10        an automatic inspection zone, in which zone is located the imaging means for capturing an image of the undercarriage of a vehicle as it is being driven into the secure site; and
- a manual inspection zone.

12. Apparatus as claimed in claim 11, further including means, under the control of the apparatus, for selectively preventing and allowing the movement of the vehicle from the identification and psychological profiling zone into the automatic inspection zone.

13. Apparatus as claimed in claim 11 or claim 12, further including means, under the control of the apparatus, for selectively preventing and allowing the movement of the vehicle from the automatic inspection zone into the manual inspection zone.

14. Apparatus as claimed in any one of claims 11 to 13, further including means, under the control of the apparatus, for selectively preventing and allowing the movement of the vehicle from the manual inspection zone into the secure site.

15. Apparatus as claimed in any one of claims 11 to 14 in which components of the apparatus that are located in at least one of:

30        the identification and psychological profiling zone;

          the automatic inspection zone; and

          the manual inspection zone

are hardened against the effects of explosive blast.

16. Apparatus as claimed in any one of claims 10 to 15, in which:

a vehicle is visible to the licence plate recognition camera on entry of the vehicle into the identification and psychological profiling zone; and  
on detection by the licence plate recognition camera of a vehicle entering into the identification and psychological profiling zone, the licence plate recognition means is triggered to capture licence plate data about the motor vehicle.

17. Apparatus as claimed in any one of claims 4 to 16, in which the means for detecting the presence of explosives associated with a motor vehicle are located in the automatic inspection zone.

18. Apparatus as claimed in any one of claims 4 to 17, in which the means for detecting the presence of explosives includes a detecting portal through which the car is driven.

19. Apparatus as claimed in any one of the preceding claims, substantially as described with reference to the drawings.

20. A method of controlling vehicular access to a secure site, which method includes the steps of:

at at least one entrance to the site, designating a plurality of inspection zones, wherein each inspection zone is contiguous with at least one other inspection zone and at least one inspection zone is contiguous with the secure site;

permitting a driver to bring a vehicle which is seeking access to the secure site to enter into an inspection zone;

conducting at least one inspection process on the vehicle in each of at least two inspection zones, wherein each inspection process has allowable outcomes which include:

the vehicle fails the inspection process and is not permitted to move out of the inspection zone; and



the vehicle passes the inspection process and is permitted to move out of the inspection zone.

21. A method as claimed in claim 20, in which one of the inspection zones is an identification and psychological profiling zone in which at least one of the following categories of data is captured:

biometric data about the driver;  
image data about the driver; and  
image data about a licence plate of the vehicle.

22. A method as claimed in claim 20 or claim 21, in which an automated inspection zone is contiguous with the identification and psychological profiling zone, which automated inspection zone includes at least one of:

an explosives detection portal for the chemical detection of explosives associated with a vehicle; and  
apparatus for capturing an image of the undercarriage of a vehicle.

23. A method for the automatic inspection of motor vehicles as they are being driven into a secured site by a driver, the method including:

storing in a database:

biometric data identifying drivers who are permitted to drive vehicles into the secure site;

licence plate data identifying vehicles which are permitted into the secure site; and

data identifying which driver is permitted to bring which vehicle into the secure site,

capturing biometric data about a driver who is driving the motor vehicle into the secure site;

capturing licence plate data about the motor vehicle which that driver is driving into the secure site; and

interrogating the database on the basis of the captured data about the driver who is driving the motor vehicle into the secure site and on the basis

of the captured data about that vehicle to determine whether or not that driver is permitted to drive that vehicle into the secure site.

24. A method as claimed in claim 23 in which the biometric data identifying drivers who are permitted to drive vehicles into the secure site includes at least one of:

an image of the face of each such driver; and  
a print of at least a portion of a hand of each such driver.

25. A method as claimed in claim 23 or claim 24, further including the steps of:  
storing data in the form of images of the undercarriages of vehicles which are permitted into the secure site;  
capturing an image of the undercarriage of a vehicle as it is being driven into the secure site; and  
comparing the captured image of the undercarriage of the vehicle as it is being driven into the site with the stored image of the undercarriage of that vehicle.

26. A method as claimed in any one of claims 23 to 25, further including the step of detecting the presence of explosives associated with a motor vehicle that is being driven into the secure site.

27. A method as claimed in any one of claims 23 to 26 further including:  
detecting physiological data about the driver who is driving the motor vehicle into the secure site;  
inferring, from the detected physiological data, information about the current psychological profile of the driver, and  
raising an alarm when the inferred current psychological profile of the driver matches specified criteria.

28. A method as claimed in claim 27, in which the specified criteria include the stress level of the driver.

29. A method as claimed in claim 28, in which the physiological data includes data about the pulse rate of the driver.

5 30. A method as claimed in claim 29, further including the step of storing base-line pulse rate data about the driver; and in which the step of inferring the current psychological profile of the driver from the detected physiological data includes a comparison of the detected pulse rate of the driver with the base-line pulse rate data for that driver.

10 31. A method as claimed in any one of claims 27 to 30, in which the physiological data is part of the biometric data.

32. A method as claimed in any one of claims 23 to 30, in which the licence plate data is captured with a camera.

15 33. A method as claimed in any one of claims 25 to 32, in which the steps of the method are performed over at least three zones, those zones including:  
an identification and psychological profiling zone, in which zone is located means for capturing biometric data about a driver who is driving the motor vehicle into the secure site;  
an automatic inspection zone, in which zone is located imaging means for capturing an image of the undercarriage of a vehicle as it is being driven  
20 into the secure site; and  
a manual inspection zone.

34. A method as claimed in claim 33, further including the step of one of:  
selectively preventing; and  
25 selectively allowing,  
the movement of the vehicle from the identification and psychological profiling zone into the automatic inspection zone.

30 35. A method as claimed in claim 33 or claim 34, further including the step of one of:

selectively preventing; and  
 selectively allowing,  
 the movement of the vehicle from the automatic inspection zone into the manual  
 inspection zone.

5

36. A method as claimed in any one of claims 33 to 35, further including the  
 step of one of:

selectively preventing; and  
 selectively allowing,

10 the movement of the vehicle from the manual inspection zone into the secure site.

37. A method as claimed in any one of claims 32 to 36, in which:  
 the camera is used to detect the vehicle on its entry into the identification  
 and psychological profiling zone; and  
 on detection of the vehicle entering into the identification and psychological  
 15 profiling zone, licence plate data for the vehicle is captured by the camera.

38. A method as claimed in any one of claims 26 to 37, further including the  
 step of, in the automatic inspection zone, detecting the presence of any  
 explosives which are associated with the motor vehicle.

39. A method as claimed in any one of claims 20 to 38, substantially as  
 20 described with reference to the drawings.

**DATED 7 January 2003**  
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## ABSTRACT

Apparatus for the automatic inspection of a motor vehicle (6) has an identification and psychological profiling zone (2), an automatic inspection zone (3) and a manual inspection zone (4). A biometric and heart rate detection station (8) and an attached console (7) are located in zone (1). An explosives detection portal (11) and undercarriage scanning and speed sensor apparatus (12) are located in zone (2). The apparatus also has a fixed camera (17), a hand-held camera (14), an alarm (18) and a spike barrier (19). The camera (17) detects the entry of a vehicle (6) into zone (2) and captures an image of the vehicle licence plate. When the captured biometric data and licence plate data indicate that the driver is authorised to drive the particular vehicle (6) into the secured zone, and if no explosives are detected, the driver is allowed to proceed.

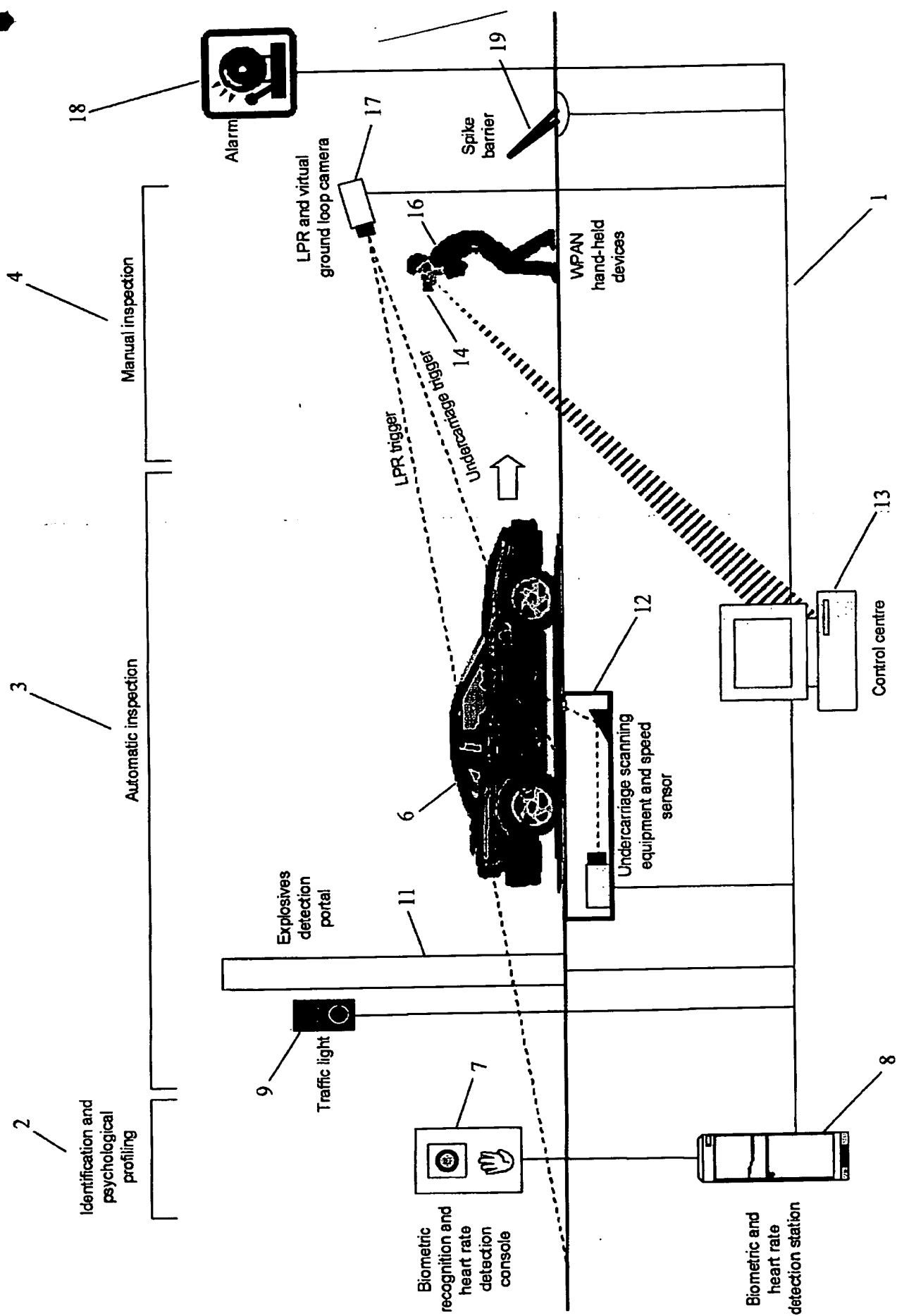


Fig 1.

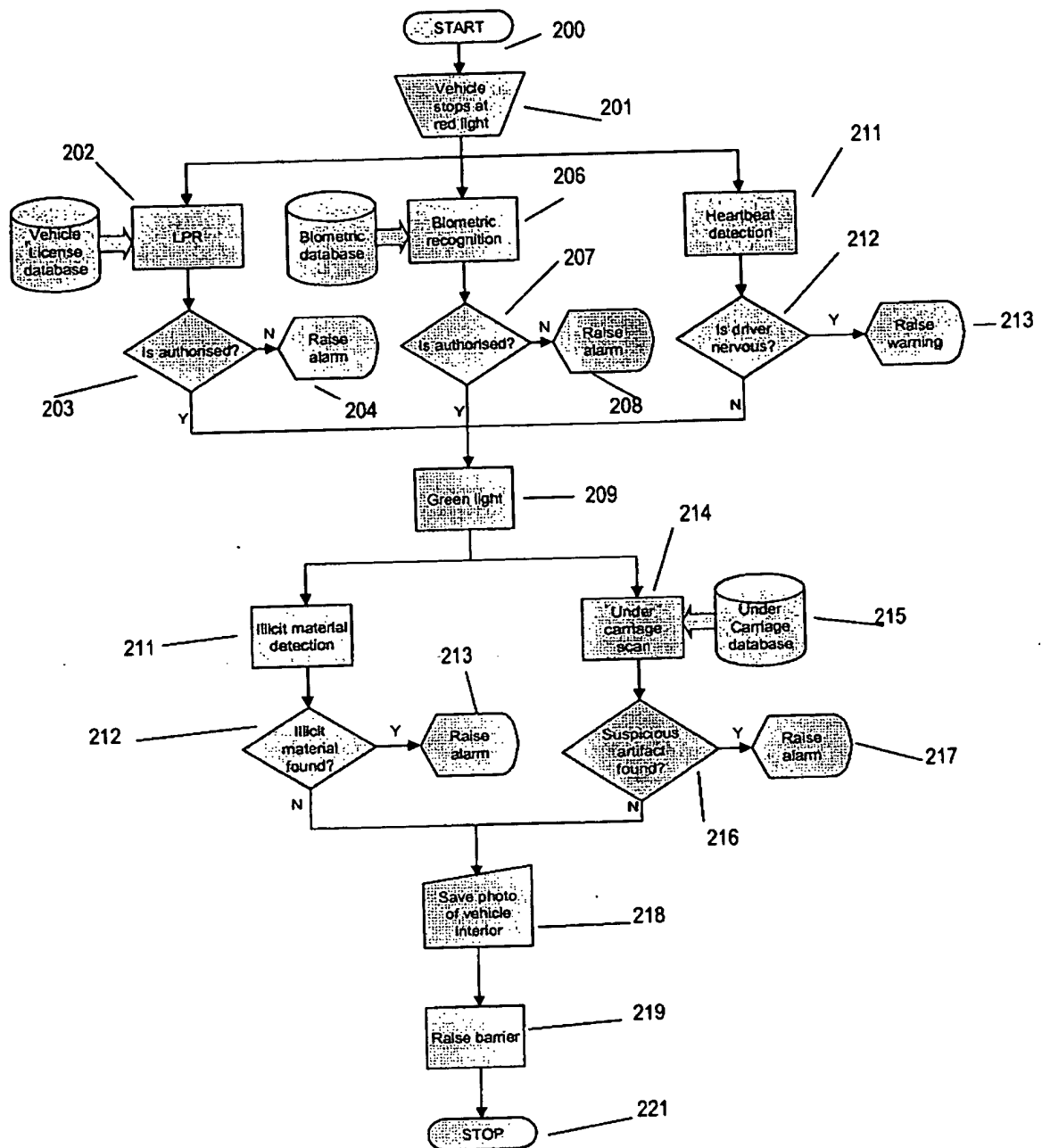


FIGURE 2

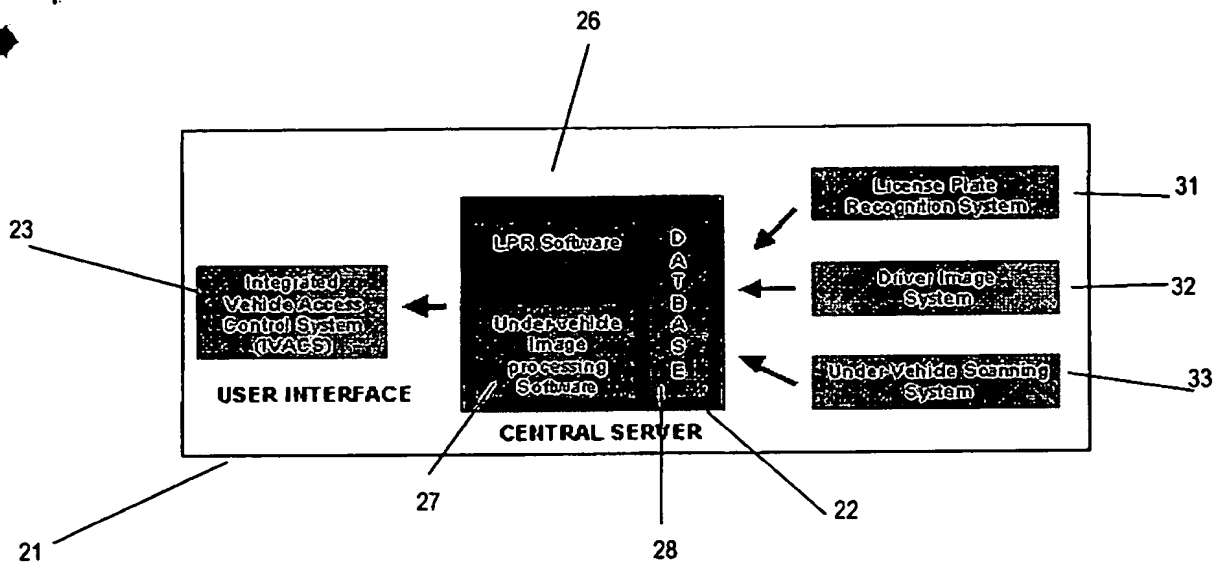


FIGURE 3



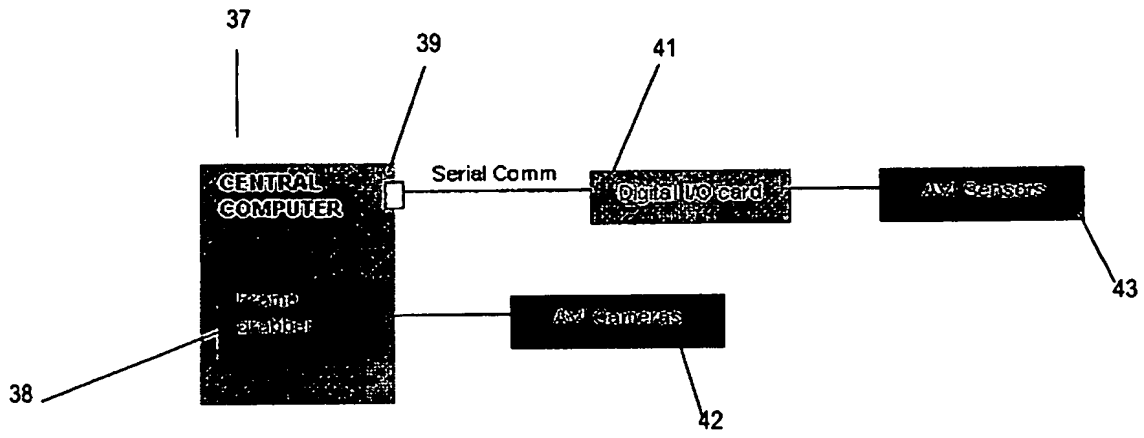


FIGURE 4

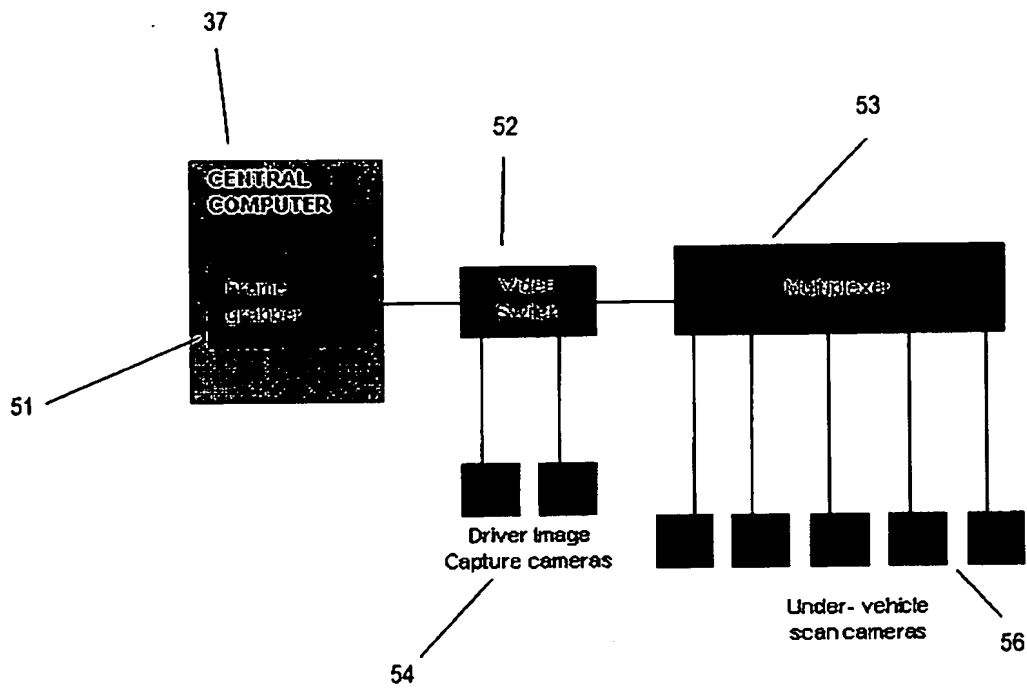


FIGURE 5

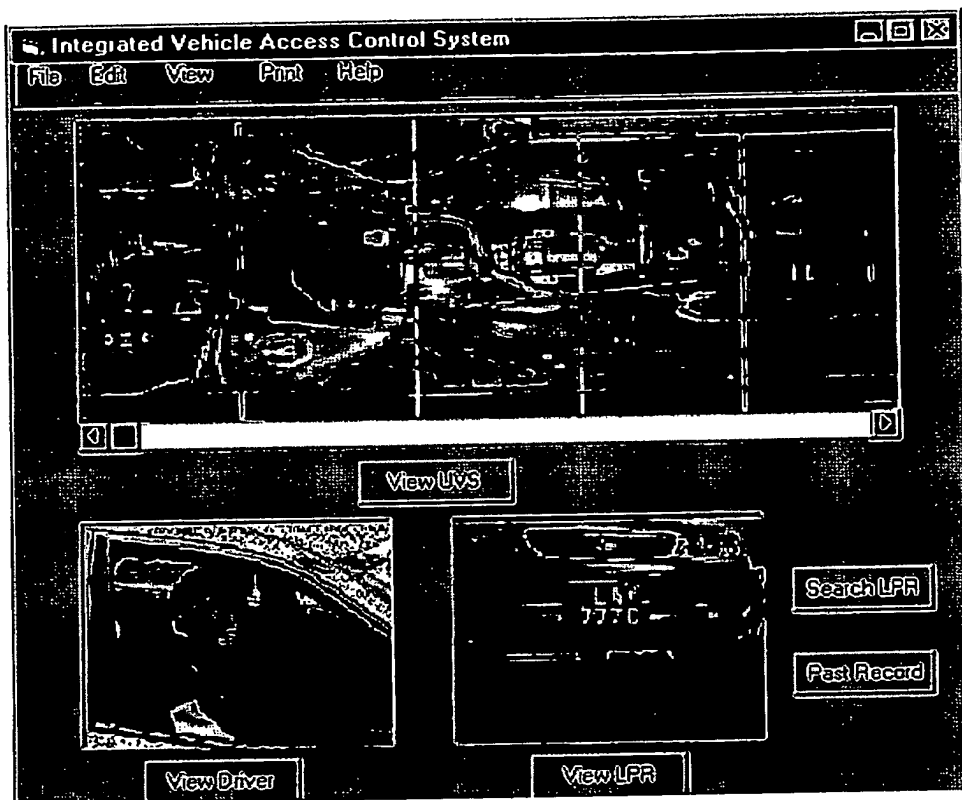


FIGURE 6